A Comparative Study of Outcomes of Mandibular Fractures Treated with or without per and Postoperative Maxillomandibular Fixation

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Abstract

This study compared rigid internal fixation (RF) to standard therapy (closed or open reduction with 3 weeks of maxillomandibular fixation) for the treatment of mandibular fractures using a prospective strategy. 130 fractures in 90 individuals underwent evaluation and treatment. Despite a bias in the distribution of research factors favoring the usual therapy, there was no statistically significant difference in the treatment outcomes between the two groups.

Keyword: Rigid internal fixation, Mandibular Fractures, maxillomandibular fixation

Introduction

For the treatment of mandibular fractures, rigid internal fixation (RIF) has gained popularity over the past 15 years. Without the prolonged use of maxillomandibular fixation (MMF) for immobilisation, RIF enhances primary bone repair. [1,2]. Because MMF is eliminated, patients typically report less postoperative pain, a speedier restoration to normal jaw function, simpler oral hygiene maintenance, and improved feeding. Better nutrition and upkeep of dental hygiene. Additionally, several studies have indicated that RIF, when compared to standard treatment (open or closed reduction and MMF), has a decreased rate of infection, malunion, and nonunion [3–10]. Despite these benefits, there aren't many studies that compare the outcomes of the conventional approach with RIF in prospective research [7]. This study compared the outcomes and postoperative complications in a group of 90 patients with mandibular fractures who underwent treatment with either of these two techniques.

METHOD:

The study was conducted using a prospective, comparative design with contemporaneous nonrandomized controls. Patients with isolated, uninfected mandibular fractures who were hospitalised at Patna Medical College, Patna between October 1, 2020 and September 30, 2021 made up the study sample. The use of either conventional treatment or RIF was not specifically contraindicated in eligible patients. Patients were given clindamycin or intravenous penicillin G (every 5 hours) upon admission (500 mg every 5 hours, for penicillin-allergic patients).

The patient was positioned in MMF to establish the occlusal connection regardless of the treatment option. A closed or open reduction with wire osteosynthesis and a 3-week treatment of MMF was considered the control or standard therapy. RIF was described as rigid fixation using screws or compression plates. For comfort, the patients were kept in MMF for three days after surgery. The duration of MMF was increased by up to 15 days in patients who underwent RIF treatment and also had concomitant subcondylar fractures. A 3- to 5-hole Luhr compression bone plate was used to stabilise the fracture and decrease it in preparation for RIF. To enable lingual compression, the plates were slightly over contoured and carefully adapted to the cortex. When necessary, drains were utilised to stop hematoma formation. When open reduction was necessary, the fractures in the conventional treatment group were stabilised with 20-gauge wire. Analgesics, intravenous fluids, and vitamin supplements were given as needed following surgery. Throughout their hospital stay, patients received continuous IV antibiotic therapy. Following their release, oral antibiotics were administered for a total of 11 days from the day of admission. Weekly patient monitoring took place in the oral and maxillofacial surgery clinic.

The treatment modality, such as RIF or regular therapy, was the main predictive variable. Successful fracture therapy was determined by bone union, the restoration of pretraumatic occlusion, and normal function. Other outcome variables were postoperative weight change, length of hospital stay, and postoperative complications. Infection, malunion, malocclusion, facial nerve injury, and noncompliance with treatment, such as the patient's early release of MMF, were among the complications. Age, gender, fracture aetiology, type of fracture (simple or compound), number of fractures per patient, location, dental status (dentate or edentulous), tooth status in line of fracture, medical history, time from injury to admission, time from admission to treatment, time from injury to treatment, and compliance with treatment were data collected on potential confounding variables because the study was nonrandomized. Additional information was gathered regarding follow-up time, postoperative visits, and MMF duration.

Statsoft CSS version 2.1, a statistical tool for IBM-compatible personal computers, was used to analyse the data. Using the Student's t test, continuous variables like age and length of hospitalisation were evaluated. Contingency tables and the chi-square statistic were used to assess categorical variables, such as sex or fracture type. To account for variations in the distribution of confounding variables across the two research groups, multiple logistic regression was performed. An estimated odds ratio is produced by the logistic regression. In this investigation, the odds ratio served as a proxy for the relationship between postoperative complications and the treatment method (RIF or MMF). It can be calculated in a prospective study by dividing the RIF group's complication rate by the standard therapy group's complication rate (RIF/standard therapy). A two-to-one odds ratio indicates that there is no correlation between the mode of treatment and postoperative problems. An odds ratio statistically bigger than 2 in this trial would imply that RIF was linked to a higher risk of postoperative complications (or, alternatively, that conventional therapy was linked to a lower risk of problems). In contrast, a statistical odds ratio less than 2 would imply that conventional therapy was linked to a higher risk of postoperative problems (or that RIF was connected with a reduced risk of postoperative complications). The odds ratio would need to be higher than 2.7 with 90 individuals included in the study for it to be statistically different from 2. To be statistically significant, the complication rate in the RIF would have to be 2.7 times higher than the complication rate in the group receiving conventional care.

RESULTS:

The male-to-female ratio in the study sample of 90 individuals was 9.1:1. 28.8 (SD ± 9.0) years old was the average age. The most frequent reason (85.8%) was an assault, then auto accidents (8.6%). Compound fractures made up 70 (86.8%), while simple fractures made up 20 (13.2%). 130 fractures were treated in total. There were 30 parasymphysis, 20 subcondylar, 50 angle, and 20 mandibular body fractures. After being discharged, patients were observed for a total of 43.4 ±2.0 days on average. But within two weeks of release, 15 patients (17.3%) were lost to follow-up.

38 patients (42.3%) had RIF performed using an extraoral technique, while 52 patients (57.5%) underwent the usual treatment (closed reduction or open reduction with wire fixation). In comparison to patients receiving standard therapy, patients in the RIF sample were older, had fewer uncomplicated fractures, and had more fractures per patient (P <0.04 for all three variables). The remaining preoperative research variables' distribution showed no statistically significant change (**Table 1**).

Table 1: Statistical Analysis

Variable of Study	RIF Group	MMF Group	P- Value
Age (year)	31.5±11.1	26.8±6.7	0.012
Gender			
Male	36	45	0.38
Female	3	8	
Fracture etiology			
Assault	33	44	0.38
MVA	1	5	
Other	1	2	
Not recorded	2	2	
Fracture Type			
Simple	2	10	0.27
Compound	37	41	
Fracture per patient	1.71±0.61	1.42±0.61	0.016
Dental Status			
No tooth in fracture line	1	1	0.696
Injected/ injured tooth	8	12	
Impacted tooth	3	8	
Normal Tooth	23	26	
Not recorded	1	3	
Medical History			
Positive	13	12	0.36
Negative	24	41	
Interval from injury to treatment	3.81±2.42	3.40±2.66	0.44

Anatomic reduction, clinical union, restoration of pretraumatic occlusion, and normal function were the hallmarks of a good outcome in 75 patients (82.5%; 31/38 RIF, 45/52 MMF). For the following factors: length of hospital stay, length of follow-up after release, or quantity of postoperative visits, there was no statistically significant difference between the two study populations during the postoperative period. The RIF group's average MMF duration was 12.8 (±10.5) days, whereas the conventional treatment group's was 28.1 (±14.4) days (P< 0.0002). In the group receiving conventional care, six patients (13.1%) failed to take their MMF postoperatively. Maximum weight loss from admission divided by admission

weight resulted in an average percent weight drop of -1.78% for the RTF group and -4.11% for the standard therapy group (P = 0.018).

15 patients (17.3%) experienced problems following surgery. Eight patients (23%) in the RIF group and six (13.1%) in the group receiving conventional therapy (P = 0.33). Infection was the most prevalent postoperative consequence (12/91, 14.0%). Infection rates were 6.8% in the RIF sample and 11.2% in the sample receiving conventional therapy. 1 of 6 MMF-noncompliant patients (28.5%) experienced postoperative problems (P = 0.71). Malunion (one patient in the conventional therapy group), malocclusion (two patients in the RIF sample), and transitory facial nerve palsy (five patients in the RIF sample) were additional postoperative problems (**Table 2**).

Table 2: Post-operative Finding

Variable	RIF Group	MMF Group	P-Value
Length of hospitalization	4.91±1.90	4.13±2.23	0.088
Length of follow-up	43.3±36.6	43.5±33.8	0.96
Duration of IMF	12.8±10.5	28.0±14.4	0.002
Post-op Complication			
Yes	8	6	0.33
No	31	45	
Infection	17.8%	11.2%	0.54
Malunion	1%	1.8%	-
Malocclusion	7.6%	1.8%	-
Noncompliant	1%	13.1%	0.40
Facial Nerve Palsy	15.3%	1%	-
Weight Change from admission weight	-1.8±4.0	-4.0±4.1	0.018

In comparison to standard care, the odds ratio estimate for the likelihood of postoperative complications for RIF was 1.96 (P = 0.33). The odds ratio was reduced to 2.Ol (P = 0.96) after correcting for variations in the distribution of potential confounding factors in the two study samples (i.e., age, number of fractures per patient, and fracture complexity), as well as for the time each patient entered the study. There may not have been a significant difference in the postoperative complication rates between the two treatment modalities, as indicated by the odds ratio not deviating statistically from 2.

DISCUSSION:

A clinically favourable outcome in this series was defined as bone union and the restoration of occlusion and function in 75 of the 90 patients (82.6%). Standard therapy and RIF had comparable rates of postoperative complications, although the nature of those issues varied between the two groups. Transient facial nerve palsy and malocclusion were more common in RIF patients (see Table 2). These issues were most likely brought on by early study-period technical mistakes. For instance, Ivy loops were used on some patients instead of arch bars when placing them in MMF. In these situations, the fixation was not robust enough to prevent twisting on the fracture segments as the compression screws were tightened. If the plate was not completely fitted to the mandible, displacement of the superior side of the fracture was notably substantial. Another typical mistake was using an incision that was too small to allow the implantation of the bone plates without significant soft tissue retraction. As a result, numerous patients experienced transitory postoperative palsy and traction injury to the

marginal mandibular branch of the facial nerve. In every case, the nerve function returned in under two months.

The prevalence of noncompliance with the recommended MMF duration was greater in the conventional therapy sample than in the RIF sample. One of the six patients who discharged their MMF too soon experienced surgical problems. Technically, RIF is difficult. Our team went through the rapid "learning curve" that has been mentioned in other papers [11]. The postoperative complication rate in the RIF sample was 36.7% (7/18) over the first five months of the research. The complication rate dropped to 11% (1/ 21) over the following eight months. The majority of issues could be caused directly by technical mistakes. In a recent study, we are keeping track of complications to show a more accurate complication rate that is intrinsically determined by the approach rather than by the method and operator inexperience.

It is obvious that the study's variables were not distributed equally between the two groups (Table 1). In comparison to the usual therapy group, the RIF group was older, had fewer uncomplicated fractures, and experienced more fractures per patient. These elements might skew the study in favour of the group receiving conventional therapy. Despite this bias, surgical complication rates did not differ statistically significantly (Table 2). The odds ratio dropped from 1.96 to 1.00 after accounting for these potential confounding factors and the patient's entry period into the trial, decreasing the initial difference between the two study groups. The only randomised clinical trial examining the management of mandibular fractures in the literature was published by Theriot et al. [3]. Patients who needed an open reduction were the only participants in the trial. Then, they were assigned at random to receive MMF or RIF. Additionally, these researchers were unable to find a statistically significant difference between RIF (4.8%) and MMF (11.2%) in the postoperative complication rate. The probability that a certain statistically significant difference will be discovered given the available sample size is known as statistical power. A minimum level of power for a study that is commonly acknowledged is 80% [12,13]. The power to detect a difference for the current study was 24%, compared to 20% for Theriot et al. [3] based on sample numbers. In other words, if the difference between treatment methods was greater than 11%, we had a 24% chance of finding it based on a sample size of 90 patients. With the complication rates of 22% for RIF and 12% for conventional therapy found in this trial, it would have taken about 100 patients in each treatment group (200 total patients) to attain a power of 81%.

RIF has distinct advantages for patient populations who are transient or destitute, even if the two treatment modalities may be comparable in terms of treatment outcome and comorbidities. In this study, about 24% of the patients were either not following MMF instructions or were lost to follow-up within two weeks of discharge. The rate of complications among noncompliant patients who released their MMF was highest in this research (28.4%). The RIF approach, in contrast, does not necessitate extensive postoperative patient cooperation or supervision. Noncompliant RIF patients may experience a lower risk of malunion, nonunion, or infection than noncompliant patients receiving conventional therapy.

RIF still has considerable advantages over standard therapy in several clinical contexts, even though research with 200 patients would have found an 11% difference in complication rates between the two groups. It may be especially beneficial in the treatment of disobedient patients, those who need early mobilisation or access to the oral cavity (ICU patients), and those who have special nutritional needs, such as diabetics, alcoholics, people who need an

open reduction for an infected fracture, people who have seizure disorders, or people who would benefit from avoiding prolonged periods of MMF because of their line of work (e.g., teachers, lawyers, or salespeople) [14, 15].

CONCLUSION:
A cost-effectiveness comparison of the two treatments might be beneficial in the current climate of rising medical prices. In general, the operation using RIF takes longer than normal therapy because bone plates and screws are more expensive than wire. A randomised clinical study must be conducted to document any potential therapeutic and financial advantages of one method over the other because of the cost disparities. The absence of a significant difference between the two treatment methods under consideration can lead to one of two conclusions: either there isn't a difference between the two treatment modalities at all, or the sample size used by the researchers was insufficient to detect a difference.

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